WIRMS 2003: International Workshop on Infrared Microscopy and Spectroscopy with Accelerator-Based Sources

Participants in WIRMS 2003 pose for the traditional group photo during a coffee break outside the Granlibakken conference center.

An international workshop on the infrared science being done with and the recent advances in infrared synchrotron and free electron laser sources was held on July 8–11, 2003 at the Granlibakken conference center at Lake Tahoe, California. This was the second biannual workshop in the series (WIRM 2001 was held in Porquerolles, France) and it was organized and chaired by Michael C. Martin (ALS), Todd I. Smith (Stanford), Wayne R. McKinney (ALS), and Daniel Palanker (Stanford). Support for WIRMS came from the ALS, Stanford, and five corporate sponsors. Over 75 participants enjoyed the stimulating scientific presentations, numerous detailed discussions, and the beautiful weather and scenery.

Representatives from the infrared scientific programs at 13 synchrotron light sources and 10 free electron laser facilities participated. WIRMS 2003 had 42 oral and 11 poster presentations in 10 topical scientific sessions. The first session covered Biomedical Spectroscopy and began with a presentation by David Piston (Vanderbilt) about the Vanderbilt FEL's recent biomedical and surgical applications. Max Diem (CUNY) then discussed IR spectral mapping and analysis of living cells and tissue sections. Lisa Miller (NSLS) and Paul Dumas (LURE) each presented talks showing how the high spatial resolution of a synchrotron IR microscopy beamline allows chemical imaging of biological systems and complements other more conventional tools available to the biomedical researcher.

In a session devoted to THz Microscopy, X.-C. Zhang (Renselear Polytechnic Institute) gave an overview of the developments of terahertz wave microscopes with examples of the current state of the art. Randy Smith (NSLS) then described the recent experimental developments at the U4IR and U12IR beamlines for using terahertz frequency synchrotron radiation for microscopy and spectroscopy applications, respectively.

After lunch, a session on New Sources included several talks about the production and use of coherent synchrotron radiation (CSR) as an emerging powerful source in the terahertz range. This session started with an overview of CSR by Gwyn Williams (Jefferson Lab), including some exciting measurements done using the Jefferson Lab's energy recovery linac to produce CSR. Ulrich Schade (BESSY) then described the THz research being done at BESSY where a low-alpha configuration allows stable CSR from a storage ring. Jason Singley (ALS) followed by describing the first scientific measurements using the BESSY CSR source, observations of the Josephson plasma frequency in the high-temperature superconductor $Bi_2Sr_2CaCu_2O_8$. Andrea Doria (ENEA) described their novel Coherent Advanced THz Source (CATS) based on an FEL

The primary organizer of WIRM 2001, Paul Dumas (LURE), on the left and of WIRMS 2003, Michael Martin (ALS), on the right during the workshop's banquet dinner cruise on Lake Tahoe.

and realized in their lab in Frascati. Fernando Sannibale (ALS) presented the design and characteristics of a proposed new CSR facility for Berkeley named CIRCE, Coherent Infra-Red CEnter. Avi Gover finished the session with a discussion of stimulated superradiance from an FEL.

A session on Advanced Techniques preceded dinner, starting with a talk by Laszlo Mihaly (Stony Brook), who has developed a high field electron spin resonance system using far-IR synchrotron radiation at the NSLS. He described the instrumentation and first set of results using this novel apparatus. Thomas Dekorsy (Forschungszentrum Rossendorf) presented experimental non-linear spectroscopy results from work using the FELIX FEL facility. Larry Carr (NSLS) finished up the afternoon with a discussion of the resolution limits for a synchrotron infrared microscope and how to best enhance it. Following dinner was a lively poster session with wide-ranging presentation topics and discussions late into the evening.

The second day began with a session on Environmental and Planetary Sciences, with the first talk by Hoi-Ying Holman (LBNL). She discussed her recent work using synchrotron IR spectromicroscopy to learn about how bacteria are able to reduce chromium compounds via the production of extracellular chromium nanoparticles. Rus Hemley (Carnegie Institute, Washington) presented an overview of recent infrared work on samples at very high pressures where the necessity of using a diamond anvil cell means that a high brightness source is required. George Flynn (SUNY Plattsburgh) then described measurements done on interstellar grains, where his group uses IR to determine the mineral composition of such grains on a microscopic scale. These efforts will aid in the interpretation of astronomical spectroscopy data and in the understanding of the composition of some of the universe. Ted Raab (Carnegie Institute, Stanford) rounded out the session with a discussion of applying synchrotron IR microscopy to agriculture and ecological systems.

In an Applied IR Microscopy session, Gary Ellis (Institute of Polymer Science & Technology, Madrid) described how synchrotron IR microscopy is aiding in understanding the micro-characterization and reliability of commercially used polymer blends and composites. Kiochi Nishikida (Thermo Electron Corp.) discussed how one can experimentally use a dark-field technique for IR microscopy and in what situations this would be advantageous.

After lunch, Giorgio Margaritondo (EPFL) gave an overview of near-field optical microscopy for the Beyond the Diffraction Limit session. This was followed by Daniel Palanker (Stanford), who described his group's efforts at near-field using transient photo-induced mirrors, apertures, and fresnel lenses, and their plans for coherent anti-stokes Raman scattering. Alexandre Dazzi (LURE) then discussed his theoretical calculations of the limits and performance of the near-field technique.

The afternoon was completed with a lively Facility News and Updates session, where the workshop heard about the recent developments at the SOLEIL, ESRF, DAFNE, ANKA, JLab, Korea Atomic Energy Research Institute, ELETTRA, CLS, SLS, and SRC facilities. Each has infrared beamlines and instrumentation operating or in development.

The workshop's banquet dinner was held that evening on the Tahoe Gal, a paddle wheel boat cruising on Lake Tahoe. Everyone enjoyed a nice dinner, lovely views of the surrounding mountains, and a fine sunset on the lake.

The final day of the workshop began with an Applied IR Spectroscopy session, kicked off by Joe Brill (U. Kentucky) discussing his group's microscopic studies of the electro-optical properties of charge-density-wave systems. Gunter Luepke (William and Mary) presented his research on the vibrational lifetimes of various hydrogen defects in silicon, which made use of the Jefferson Lab IR FEL to attain high powers and ps time resolutions. Mark Sherwin (UCSB) then presented an overview of the Santa Barbara THz FEL's with an emphasis on research on semiconductors and how their properties can be modified by the application of strong THz fields. Willie Padilla (UCSD) discussed his research into artificial metamaterials leading towards left-handed optical systems. Carlos Melendres and Francoise Hahn (U. Poitiers) presented how far-IR reflectance measurements using a synchrotron allow them to measure surface layer formation and geometry in electrochemical cells.

WIRMS 2003 concluded with a session on Strongly Correlated Materials, led off by Dimitri Basov (UCSD) presenting work on using infrared to observe inhomogeneities in the superconducting state of high-T_C cuprate superconductors. Robert Kaindl (LBNL) followed with a description of THz time-domain spectroscopy and how they it is being used as a probe in insulating, conducting and superconducting phases of novel materials. Finally, Larry Carr (NSLS) presented time-resolved THz spectroscopy done using a pump laser synchronized to the NSLS VUV synchrotron light pulses to study MgB_2 and MoGe films.

All involved found the workshop to be a great success, and WIRMS 2005 is in the initial planning stages to be held in either Germany or Italy. For more information on WIRMS 2003, including many presentation files and photos, please see: http://infrared.als.lbl.gov/WIRMS/ ■

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